Vermont-PASS Science Blueprint: Appendix - Grade 9

Preparing for the Vermont-PASS Assessment

Detailed administration manuals will accompany the Vermont-PASS assessment. However, there are several things that would be beneficial for teachers, administrators and test coordinators to consider ahead of time and are therefore included in this Blueprint. It is also important for test coordinators and teachers who will be administering the assessment to attend pre-assessment training sessions that will be conducted regionally prior to the testing window.

Vermont-PASS Test Coordinators

It is the responsibility of the test coordinator to ensure that all teachers administering the assessment understand the test administration and security procedures. The test coordinator must receive, store in a locked facility, and return all test booklets. The test coordinators will also be responsible for distributing the hands-on materials for the performance task investigations. These materials will be shipped in bulk, and will need to be separated into individual student set ups. In small elementary schools, this task will not be very time consuming. However, in larger schools, particularly high schools, a test coordinator might be dealing with hundreds of student hands-on material sets. It is recommended that adequate time be set aside for this organizational task. Larger schools might also consider utilizing student lab assistants to help organize the hands-on materials.

Students

Teachers are encouraged to share the Vermont-PASS practice tests with their students in order to familiarize them with the components of the test. Teachers might also want to remind students that although scientists frequently work in collaborative groups, students will be asked to work alone on the assessment performance task. This is to provide an accurate measure of what each student knows and is able to do.

Teachers

It is recommended that teachers administering the Vermont-PASS assessment become familiar with the test, particularly the performance task investigation prior to the scheduled administration time. It is also recommended that the performance task be administered in a regular lab or classroom environment. When teachers review the task and materials they can decide if they want to use their customary materials management strategies or devise something different for the Vermont-PASS materials.

Scheduling

As mentioned above, it is recommended that the performance task be administered in a science lab or classroom environment even if the school needs to combine groups for the other parts of the assessment. This strategy also alleviates problems associated with providing non-supplied materials such as water or eye protection.

Name: _____

Performance Task Grade 9
Scuba Divers

Two identical twins named Jill and Rachel were planning separate trips to go scuba diving. Jill planned to scuba dive in the ocean off the coast of Maine and Rachel planned to scuba dive in Lake Champlain.

Scuba divers who dive in cold-water locations such as the ones the girls had chosen, must wear wet suits. Wet suits make you more buoyant (cause you to float). In order to sink, divers add lead bars to their belts. Jill and Rachel are the same size and the same weight, however, they were told that they would need to add different amounts of lead to their belts because one planned to dive in the ocean and the other planned to dive in a lake. The girls were curious about this and wondered if the different "sink weights" had something to do with their density compared to the density of the ocean and the lake. They decided to investigate density in order to help them understand this confusing situation. Their investigation question was
"How does the density of an object compare to the density of the liquid in which it is submerged?"

1) Using the experience of Jill and Rachel and your understanding of density, predict (formulate a hypothesis) about how the density of an object must compare to the density of a liquid in order for the object to sink in the liquid. Explain your thinking.

_____

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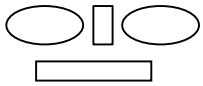
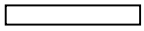
_____

_____

Part 1:
Follow this experimental procedure in order to test your hypothesis:

Materials For Part 1 Of The Experiment

- metric balance 
- density cube set (metal, PVC, acrylic)
  Optional: small metal object, rubber stopper, PVC plastic
- metric ruler 

- Calculate the **volume** of each cylinder in cm^3 (calculators can be used). You can find the volume by measuring the area of the base of the cylinder (area $=\pi \times r^2$) and multiplying it by the cylinder's height.

Use this space below for calculations and to record your results:

- Use the metric balance to find the **mass** of each solid cylinder in grams.

Use this space below for calculations and to record your results:

- Calculate the **density** of each solid cylinder using the following formula: {density = mass ÷ volume}. Your calculation should be rounded to **tenths** place.

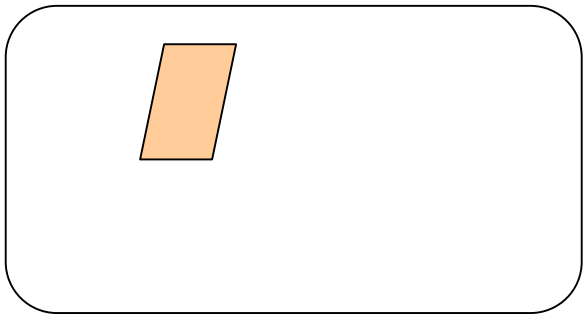
Use this space below for calculations and to record your results:

2. Organize the data you just collected into a table. The title of the table will be “Mass, Volume, and Density”. Create, organize and clearly label the table (make sure you include the units of measurement). Your table should include all objects tested and data collected.

Mass, Volume, and Density

Materials For Part 2 Of The Experiment

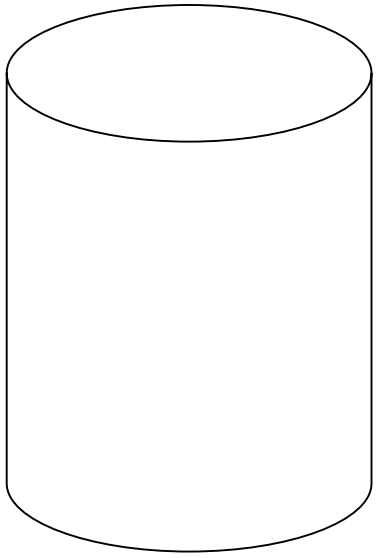
- 200 ml clear beaker or similar size clear container 
- 50 ml corn syrup, 50 ml mineral oil, 50 ml colored water 

- tray and paper towels 

Part 2:

- Carefully pour 50 ml of each of the three liquids into the same beaker making layers in the following order:
  Liquid 1: corn syrup
  Liquid 2: colored water
  Liquid 3: mineral oil
- Carefully drop the metal cylinder into the beaker. metal
- Carefully drop the acrylic cylinder into the beaker. acrylic
- Carefully drop PVC cylinder into the beaker. PVC

3) Make a diagram with labels that represents the positions of the liquids and solids in the beaker.



- Jill and Rachel did an internet search to find the densities of the three liquids. The results of their research are included in the following table.

Liquid	Density
corn syrup	1.4 g/cm^3
water	1.0 g/cm^3
mineral oil	0.84 g/cm^3

4) Do the results of your experiment and the data that the girls found on the internet support your hypothesis about how the density of an object compares to the density of a liquid in which they are submerged? Explain your thinking. (Provide specific examples from the data on how the experimental results support or refute your predictions.)

5) If the acrylic cylinder was twice the volume, what would its position in the beaker be? Explain.

6) If salt water has a density of 1.2 g/cm^3 and fresh water has a density of 1 g/cm^3, then which of the twins will need to add more "lead" to her weight belt in order to sink: **Rachel in Lake Champlain** or **Jill in the Ocean?**

Explain your thinking.

7) When water changes state from a liquid to a solid it becomes ice and floats on the liquid water. Use the understanding that you gained from doing this experiment to explain what happens to the density of water when it changes from a liquid to a solid?

Vermont-PASS Sample Test

Grade 9 Performance Task and Alignment With PASS Performance Task Development Template

"Scuba Divers"

1. Scenario:

Two identical twins named Jill and Rachel were planning separate trips to go scuba diving. Jill planned to scuba dive in the ocean off the coast of Maine and Rachel planned to scuba dive in Lake Champlain. Scuba divers who dive in cold-water locations such as the ones the girls had chosen, must wear wet suits. Wet suits make you more buoyant (cause you to float). In order to sink, divers add lead bars to their belts. Jill and Rachel are the same size and the same weight, however, they were told that they would need to add different amounts of lead to their belts because one planned to dive in the ocean and the other planned to dive in a lake. The girls were curious about this and wondered if the different "sink weights" had something to do with their density compared to the density of the ocean and the lake. They decided to investigate density in order to help them understand this confusing situation. Their investigation question was "How does the density of an object compare to the density of the liquid in which it is submerged?"

VT Framework:	Inquiry – 7.1 bb., cc., dd. Space, Time, Matter – 7.12 aa. Notation and Representation- 1.17aa.
NSES:	Inquiry – 1.3, 1.4, 1.5, 1.7, 1.8, 2.5 Physical Science 1.1

2. Problem Statement:

"How does the density of an object compare to the density of the liquid in which it is submerged?"

3. Prediction-Hypothesis:

1) Using the experience of Jill and Rachel and your understanding of density, predict (formulate a hypothesis) how the density of an object must compare to the density of a liquid in order for the object to sink in the liquid. Explain your thinking.

Scoring Guide:

Key Elements: 1. Hypothesis includes cause (density of an object, liquid or both) and effect (object sinks or does not sink in the liquid)
2. Hypothesis states a rational based on the scenario or prior knowledge.

Score Points: 2 points = 2 key elements
1 point = 1 key element

Students can receive points for both key elements even if their reasoning is flawed. If students collect accurate data, it will be important for them to address the flaws when they answer question #4.

4. Experiment:

Materials

- 200 ml clear beaker or similar size clear container
- 50 ml corn syrup, 50 ml mineral oil, 50 ml colored water
- metric balance
- density cylinder set (metal, PVC, acrylic)
  Optional: small metal object, rubber stopper, PVC plastic
- metric ruler
- tray and paper towels

Management

Field trial analysis of this task recommends separating the materials for Parts 1 and 2 to avoid student confusion. Also, stations containing the three liquids can be set up (preferably near sinks) so that when a student needs the corn syrup sample, he or she can go to an empty corn syrup station. This saves time in set up and avoids the mess of having each student pour and measure at their own desk.

Part 1:

- Calculate the volume of each cylinder in cm^3 (calculators can be used). You can find the volume by measuring the area of the base of the cylinder (area = πr^2) and multiplying it by the cylinder's height.
- Use the metric balance to find the mass of each solid cylinder in grams.
- Calculate the density of each solid cylinder using the formula density = mass ÷ volume. Your calculation should be rounded to tenths place.

Note: The cylinders described in this task have a volume of 1 cm^3 and can be obtained from the STC kit *Floating and Sinking* (Carolina Biological Supply) . Common objects can also be substituted. Metal objects sink in the syrup. Rubber stoppers will sink in the oil and water, but float on the syrup. Polyvinylchloride plastic (credit cards, shower curtains, etc.) sink in the oil but float on water. The problem with non-rectangular objects is that the students will need to use displacement to find volume and need to be accurate to tenths place.

5. Data collection and organization:

2) Organize the data you just collected into a table. The title of the table will be "Mass, Volume, and Density". Create, organize and clearly label the table. Your table should include all objects tested and data collected.

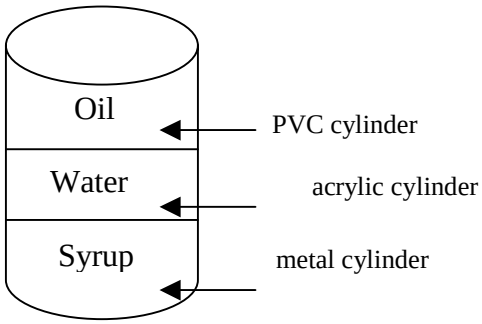
Scoring Guide:
Key Elements: 1. table is clearly organized in row and column format, columns or rows are labeled and the table contains the objects measured and mass, volume, and density, and units of measurement are included.
2. table includes data for each variable measured (volume, mass, density for all three objects) and the density calculations are correct order (metal – high, PVC – low).
Score Points: 2 points = 2 key elements
1 points = 1 key element

Part 2:

- Carefully pour 50 ml of each of the three liquids into the beaker in the following order:
  Liquid 1: corn syrup
  Liquid 2: colored water
  Liquid 3: mineral oil
- Carefully drop metal cylinder into the beaker.
- Carefully drop acrylic cylinder into the beaker.
- Carefully drop PVC cylinder into the beaker.

3) Make a diagram with labels that represents the positions of the liquids and solids in the beaker.

Scoring Guide:
Key Elements: 1. Diagram is clear and labeled
2. diagram contains the correct position of materials



Score Points: 2 points = 2 key elements
1 point = 1 key element

7. Use of evidence:

4) Do the results of your experiment and the data that the girls found on the internet support your prediction about how the density of an object compares to the density of a liquid in which they are submerged? Explain your thinking. (Provide specific examples from the data on how the experimental results support or refute your predictions.)

Scoring Guide:
Key Elements: 1. Response clearly cites evidence from the experiment as supporting or refuting the hypothesis.
2. Response accurately compares the density of the objects to the density of the liquids.

Score Points: 2 points = 2 key elements
1 score point = 1 key element

5) If the acrylic cylinder was twice as big, what would its position in the beaker be? Explain.

Scoring Guide:
Key Elements: 1. position would stay the same
2. size of an object does not change the density
or
as size increases, mass also increases so density stays the same
or
density is a rate ratio that stays constant for the materials in the experiment
Score points: 2 points = 2 key elements
1 point = 1 key element

6) If salt water has a density of 1.2 g/cm^3 and fresh water has a density of 1 g/cm^3, then which of the twins will need to add more "lead" to her weight belt in order to sink
Rachel in Lake Champlain or Jill in the Ocean?
Explain your thinking.

Scoring Guide:
Key Elements: 1. Jill because salt water is more dense than fresh water
Or
Jill because she needs a density greater than 1.2 g/cm^3 but Rachel only needs a density greater than 1 g/cm^3,
Or
Jill because the salt water is more dense and will hold her up more than fresh water.

Score Points: 1point = I key element

7) When water changes state from a liquid to a solid it becomes ice and floats on the liquid water. Use the understanding that you gained from doing this experiment to explain what happens to the density of water when it changes from a liquid to a solid?

Scoring Guide:
Key Elements: 1. Ice is less dense than liquid water
Or
The ice becomes less dense
Or
The ice is not dense enough to sink in the liquid water
Or
The liquid water holds up the ice like it did the PVC cube

Score Points: 1 point = 1 key element

Constructed Response Questions

Directions:

You will be completing two constructed response questions.

Project Blackbird
and
Thunderstorm

Please read each question and write your answers. Your answers will be judged on

- How well you show your understanding of science; and
- How well you can explain it to others.

Write your response in the space after each question. You may include a diagram to help explain your answer.

An agricultural company introduced a species of insect to the state of Vermont to help pollinate certain crops. This species quickly multiplied and became a major pest. A scientist working for the state is considering introducing a species of blackbird that eats these insects and might limit the growth of their population. The proposed project is called Project Blackbird.

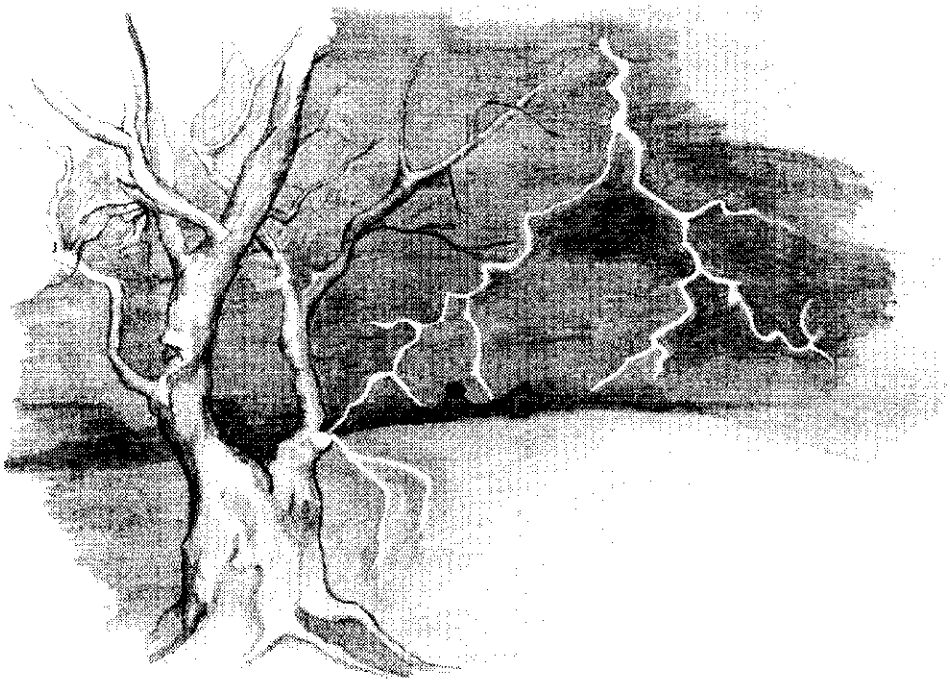
1) List **two** questions the scientists should research about this species of blackbird before introducing it to Vermont.

2) Choose **one** of the questions you listed. Explain why the scientist needs an answer to this question in order to evaluate Project Blackbird and decide if the blackbirds should be introduced to the state.

3) After five years of study, what data would show that Project Blackbird was a success?

4) Soon after the blackbirds were introduced to control the insect pests, the population size of another species of bird decreased rapidly. Could the scientist conclude that this decrease was due to the introduction of the blackbirds? Why or why not?

During a thunderstorm a lightning bolt strikes a tree.



1) Identify **three** forms of energy involved in this situation.

_____

_____

_____

2) As lightning is generated and strikes a tree, how is one of the three forms of energy you identified transformed into another?

_____

_____

_____

_____

3) Name one form of energy that travels in waves.

_____

Vermont-PASS Sample Test
Grade 9 Constructed Response Questions

Project Blackbird
VT Framework: Inquiry – 7.1 aa., gg.,cc.
Living World – 7.13 cc.
NSES: Inquiry – 1.1, 1.5, 1.6
Life Science 4.4

1) List **two** questions the scientists should research about this species of blackbird before introducing it to Vermont.

Scoring Guide:

Key Elements:
- Will it control the pests?
- What other things does the bird eat?
- What eats the bird?
- What other animals eat the insect pest?
- Does it harm other organisms?
- Can it survive in Vermont's environment and/or climate?
- How fast does it reproduce?
- Any other reasonable question concerning the lifestyle of the bird that would influence whether or not they should introduce it into the state?

Score Points:
2 points = 2 key elements
1 point = 1 key element

2) Choose **one** of the questions you listed. Explain why the scientist needs an answer to this question in order to
evaluate Project Blackbird and decide if the blackbirds should be introduced to the state.

Scoring Guide:

Key Elements: Listed in an order to correspond with the questions listed in # 1
- The birds must eat enough of the pests to control them.
- The birds might prefer to eat other things instead and not be a very good method of pest control.
- The birds might be easily eaten by other animals (population of birds might get wiped out).

Or

The birds might not get eaten by other animals (population of birds might grow too large and be unregulated).
- The birds might cause competition with other animals.
- The birds might harm other animals or plants.
- The birds must survive to be a good method for controlling the pest.
- It is important to know how fast or slow the blackbird population will grow to determine how many to introduce.
- Any other response that explains why a certain question is valid for determining if the birds should be introduced into Vermont.

Score Points:
1 point = 1 key element

3) After five years of study, what data would show that Project Blackbird was a success?

Scoring Guide:

Key Elements:
- The scientist could conclude that Project Blackbird was a success if there were fewer insects at the end of five years than at the start.

Or

- Any response that indicates a reduction in the number of pests.

Score Points:
1 point = 1 key element

4) Soon after the blackbirds were introduced to control the insect pests, the population size of another species of bird decreased rapidly. Could the scientist conclude that this decrease was due to the introduction of the blackbirds? Why or why not?

Scoring Guide:

Key Elements:
- No, because there is no proof that the blackbird's presence is any way linked to the decline in the other population of birds. It might be due to other factors.

Score Points:
1 point = 1 key element

Thunderstorm

VT Framework: Space, Time, Matter – 7.12 ee.

NSES: Physical Science – 3.1

1) Identify **three** forms of energy involved in this situation.

Scoring Guide:

Key Elements:
- Light
- Heat
- Sound
- Electrical/electricity
- Electromagnetic
- Chemical (tree may burn)
- Potential/kenetic/radiant energy

Score Points:
3 points=3 key elements
2 points = 2 key elements
1 point = 1 key element

2) As lightning is generated and strikes a tree, how is one of the three forms of energy you identified transformed into another?

Scoring Guide:

Key Elements:
- Electric energy is transformed into light energy/heat energy/chemical energy.

Or
Heat energy is transformed into sound energy
Or
Chemical energy is transformed into light energy/heat energy/sound energy.

Score Points:
1 point = 1 key element

3) Name one form of energy that travels in waves.

Scoring Guide:

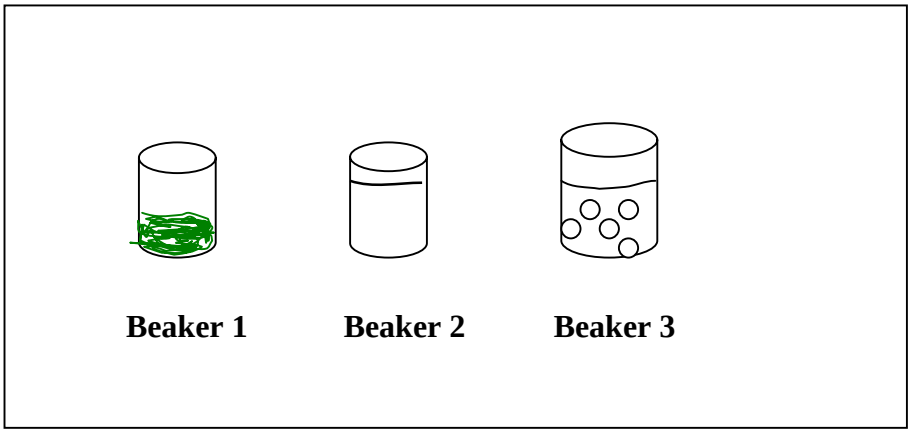
Key Elements:
- Light
- Sound
- Electromagnetic

Score Points:
1 point = 1 key element

Multiple – Choice Questions

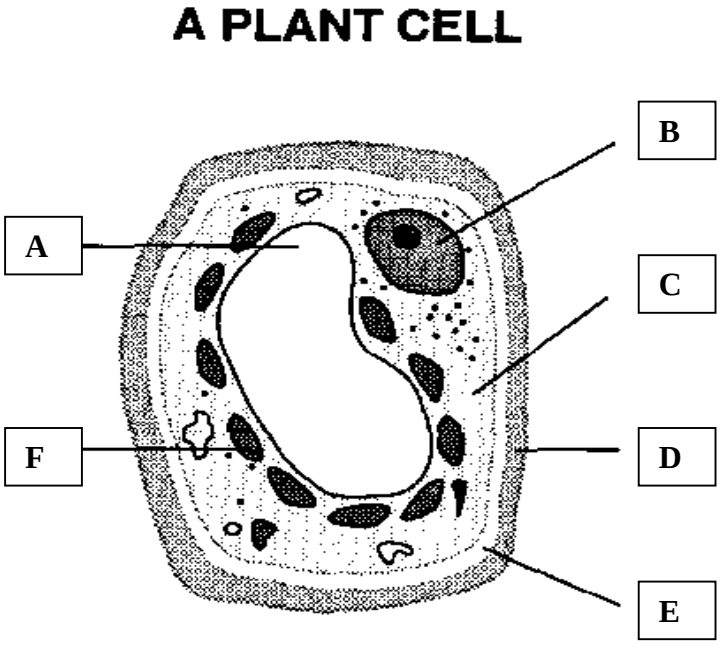
Directions:

Mark the **one** best answer for each question.



1) Beaker **1** contains a solid powder. Beaker **2** contains a clear liquid. When the contents of 1 and 2 were carefully poured into beaker 3, the gas bubbles that formed provided evidence that

A) only a physical change took place.
B) only a chemical change took place.
C) both a physical and chemical change took place.
D) air mixed with the substances from 1 and 2.



2) In the cellular diagram above, what would be the result of the removal of structure B?

A) The cell would no longer be able to carry on life processes and would die.
B) There would be no consequence from the removal of structure B.
C) The nucleus would move to another cell.
D) Structure F would perform the function of B.

3) A meteor approaching earth begins to decrease in size as it enters the atmosphere. Why does this occur?

A) Air pressure causes the meteor to shrink.
B) Friction causes it to burn as it moves through the air.
C) Earth's gravity causes the meteor to shrink.
D) The earth's rotation causes it to lose mass as it falls.

4) We have seasons because

A) the earth is closer to the sun in warm seasons and farther away in cold seasons.
B) there are variations in the amount of the sun's energy hitting the surface due to the tilt of the earth on its axis.
C) there is a variation in the amount of the sun's energy hitting the surface of the earth due to regular fluctuations in the amount of energy the sun releases.
D) heat energy from within the earth varies in regular cycles.

Vermont-PASS Sample Test
Grade 9 Multiple-choice Questions

1) Beaker **1** contains a solid powder. Beaker **2** contains a clear liquid. When the contents of 1 and 2 were carefully poured into beaker 3, the gas bubbles that formed provided evidence that

A) only a physical change took place.
B) only a chemical change took place.
C) both a physical and chemical change took place.
D) air mixed with the substances from 1 and 2.

VT Framework: Space, Time, Matter – 7.12 bb

NSES: Physical Science 1.2

2) In the cellular diagram above, what would be the result of the removal of structure B?

A) The cell would no longer be able to carry on life processes and would die.
B) There would be no consequence from the removal of structure B.
C) The nucleus would move to another cell.
D) Structure F would perform the function of B.

VT Framework: Living World-7.13aa.

NSES: Life Science 1.2

3)A meteor approaching earth begins to decrease in size as it enters the atmosphere. Why does this occur?

A) Air pressure causes the meteor to shrink.
B) Friction causes it to burn as it moves through the air.
C) Earth's gravity causes the meteor to shrink.
D) The earth's rotation causes it to lose mass as it falls.

VT Framework: Space, Time, Matter – 7.12 dd

NSES: Physical Science 2.3

4)We have seasons because

A) the earth is closer to the sun in warm seasons and farther away in cold seasons.
B) there are variations in the amount of the sun's energy hitting the surface due to the tilt of the earth on its axis.
C) there is a variation in the amount of the sun's energy hitting the surface of the earth due to regular fluctuations in the amount of energy the sun releases.
D) heat energy from within the earth varies in regular cycles.

VT Framework: Universe, Earth, Environment - 7.15 dd.

NSES: Earth Science: 3.4